NOTES ON LAND LEECHES

BY

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In his 'Notes and Queries on Land Leeches' last December Mr. Smythies raises some interesting questions and gives us the benefit of some very useful observations (Smythies 1953). Although I am not the best person to discuss leeches, I have recently been carrying out some tests of a 'new dope' to which he refers and I have been giving some thought to the very problems which he poses.

SPECIES AND DISTRIBUTION

Leeches are not popular, even among zoologists, and their students are sparse. Workers in India, Pakistan, Burma and Ceylon are fortunate to have available that magnificent work 'The Fauna of British India' in which a volume of Hirudinea by Harding and Moore was published in 1927. It is still available, price 25 shillings, and in spite of its content of technical matter contains much that is readable. Professor J. Percy Moore, who deals with the bloodsucking leeches, was and is a world authority on the subject, although he is now living in retirement in the United States of America. For workers in Malaya and Borneo, two further papers by Professor Moore appeared in the *Bulletin of the Raffles Museum, Singapore* (Moore 1935 and 1938). A general review of the subfamily Haemadipsinae in French by Blanchard was published in 1917 in the *Bulletin de la Société de Pathologie Exotique* (Blanchard 1917).

Land Leeches comprise the subfamily Haemadipsinae of the family Hirudidae (or Gnathobdellidae of some authors) and are confined to Southern and Eastern Asia and to Australasia. Two aberrant species, one from South America and the other from Europe, are also ascribed to the sub-family, but there is no evidence that they are of the land-leech habit. All the species from the Indian region belong to the single genus *Haemadipsa.*

The following species have been described from the Indo-Malaysian Region (excluding Philippines):—

Haemadipsa zeylanica Moquin-Tandon, with very many colour forms widespread over Ceylon, India, Pakistan, Malaya and Borneo.

H. montana Moore, from the mountains of India, Pakistan, and Burma.

H. sylvestris Blanchard, a lowland form from Burma, Malaya, Borneo, Java, and Sumatra.

H. ornata Moore, a mountain species from Assam, said to have a 'stinging' bite.

H. picta Moore, the corresponding mountain species from Malaya and Borneo, also with a stinging bite.

? *H. dussumieri* Blanchard, described from a specimen doubtfully from Southern India.

Tritetrabdella scandens Moore, from Malaya (Penang).
Phytobdella catenifera Moore, from Malaya.

Other related species are known from the Philippines etc.

I cannot claim much ability in identifying these leeches, but the following key (modified after Moore) may be of assistance. I should explain that a leech contains 34 segments (somites) each of which is divided externally into a number of rings (annuli). The number of annuli to the somite can be detected by counting the number between successive pores.

KEY TO LAND LEECHES

1	Middle somites with 5 annuli each ...	*Haemadipsa* 3
—	Middle somites with more or less ...	2
2	Middle somites with 4 annuli ...	*Tritetrabdella*
—	Middle somites with 6 annuli ...	*Phytobdella*
3	Eyes 3 and 4 on adjacent annuli (prehensile papilla well developed) ...	*H. zeylanica*
—	The annuli bearing eyes 3 and 4 separated by a complete or partial annulus ...	4
4	Posterior sucker with a well developed prehensile papilla. Furrow pits poorly developed. Mountains of Indian region ...	*H. montana*
—	Prehensile papilla but little developed. Furrow pits on somites VIII and XI distinct ...	5
5	Sucker rays usually less than 79, colour dull brown with black stripes ...	*H. sylvestris*
—	Sucker rays usually 80 or more, colours bright red and yellow ...	6
6	Sucker rays more than 86. Mountains of Assam	*H. ornata*
—	Sucker rays less than 89. Mountains of Malaya and Borneo ...	*H. picta*

Food and Length of Life

Land leeches certainly do suck blood; Mr. Smythies raises the question as to whether they must have blood to live, or whether they can exist on other substances, such as humus. He points out that leeches seem to be present in such large numbers that it is difficult to believe that they can all obtain a blood meal. The same question has been intriguing me a good deal.

I incline to the belief that they feed only on blood, although I agree that more evidence is needed. I have tried keeping *Haemadipsa zeylanica* in a glass jar containing earth and leaf-litter, covered with cloth to prevent their escape. One group of such leeches, partly engorged when put in, and thereafter deliberately starved, lived for five months, and died off when the jar became dried up during my temporary absence. During these five months the leeches were active whenever the jar was examined but became very thin, and apparently less numerous (they were difficult to count). The reduction in number could, of course, have been due to cannibalism, a phenomenon which has misled workers with other animals, such as trombiculid mites. I can say only that I saw no sign of it, and I assume that the reduction in numbers was due to the natural death rate

under such conditions. The fact that the leeches became very thin argues that they obtained no nutriment from the soil, dead leaves, or the soil fauna (of which a variety of minute arthropods were present). As confirmatory evidence Buffalo Leeches (*Hirudinaria manillensis*) have been kept in clean tap-water unfed for more than five months without their getting even thin.

Such evidence is by no means conclusive, but it argues that land leeches can starve for at least five months. The next question is what chance a leech has of getting a blood meal during that period.

I have a patch of lowland dipterocarp forest under observation for other experiments, where land leeches are numerous. Land leeches are always to be found there and I get the impression that in the wetter parts during suitable weather I meet about one per yard of slow walking. Let us assume (and it is an assumption) that there is a resident population of one leech per square yard of valley bottom. Marking experiments have given a fair idea of the small mammal population of this strip of forest. I estimate that in an area of about 100,000 square yards there is a resident population of at least between forty and fifty rats mostly of the species *Rattus mülleri*, *R. rajah*, and *R. whiteheadi*. The area is also used by pigs, mouse-deer and occasional other ungulates, cats and civets of several species, tree-shrews, and shrews—I am considering only mammals which frequent the ground. Estimating from a map I should say that approximately half the area is suitable for leeches, and that the forty or fifty rats cover this area in their home range.

We have therefore, estimating one leech per square yard of suitable land, a population of 50,000 leeches with 40–50 rats and proportionate numbers of other animals to support them. Allowing one feed per 100 days (3½ months) the leeches could be supported on the rats alone at a rate of ten leech-feeds per rat per day. If we allow that rats form roughly half the ground-dwelling mammal population this rate would be reduced to 5 feeds per rat per day. Is this reasonable ? I would suggest that it is.

These calculations must not be taken too seriously. A lot is guesswork. If anything the leech population has been overestimated, perhaps even wildly overestimated, since the leeches are probably concentrated along tracks, giving a false impression of their abundance, and one's impressions are gained from the worst spots rather than from the average. The mammals on the other hand are probably underestimated. Forty or so is the number of marked rats actually known to be present in the area at any one time; there are probably many more unrecorded. The result, however, of overestimating the leeches and underestimating the mammals is a reasonable figure, so we are safe in saying that leeches *can* get sufficient blood to keep them going.

The next question is whether leeches do feed on such mammals as rats in nature. I should like information on that point. I have found leeches in the nasal cavity of rats, but I have never found a wild rat with a leech attached anywhere else. Leeches detach so readily, however, that many could have detached and gone before the rat-trap was visited. I have tried feeding leeches on rats under laboratory conditions, i.e. in small cages. The leech will attach and engorge readily, but the rats I have tried (*Rattus mülleri*, *R. sabanus* and *R. rajah*) have been too skilful at finding the leeches. All leeches tried have been detected before the feed

was completed and most were either bitten to death or eaten. It may well be however, that in the wild the rat does not pay so much attention to leeches. Animals other than rats, such as mouse-deer, pigs and so on, would presumably be much less efficient at finding the leeches on their bodies.

Habits

The next group of questions may be summarised as 'How do land leeches find their prey'? Stammers (1950) gives a useful summary and an account of experiments in the Cambridge journal *Parasitology*. No clear answer can be given to the question, but they seem to use a variety of senses : sight (they have ten simple eyes), a sense of warmth and air-movement, vibration of the ground, smell, and touch. All these senses are used at times, and it seems likely that all are in fact used in finding their prey.

The most interesting question is that of their dropping out of 'trees' on to their host. My own impression is that, although this undoubtedly occurs, it has been much exaggerated. Most land leeches can and do climb on to herbage and low bushes, the sort of vegetation against which animals brush as they pass. Some of the species, *H. ornata* and *H. picta* for instance, are regarded as 'tree-climbing' species, but I think that the word 'tree' must be interpreted as meaning bushes and saplings some five to ten feet high. I have watched leeches dropping from leaves some three to six feet above the ground, but unfortunately they were always ones I had put there myself. Such leeches, however, alerted by my presence would search in all directions. If there was an object beneath them they would reach downwards and, if unable to reach it, would suddenly become limp, let go their hold, and drop. They could be encouraged to drop by an arm held a foot or two beneath them, but they would also drop, although less readily, at an inanimate object such as a *parang* (bush knife). My impression was that they dropped at sight encouraged by warm air currents. They would also drop, however, when there was nothing beneath but something (myself) in the vicinity. This dropping was clearly for a different reason, it would occur when the leech was searching for me, but had come to the end of available leaves and twigs and was unable to make progress in my direction. It would drop to the ground and immediately make for me again.

Repellants

Most of the standard repellants used against insects and mites seem effective against leeches. Dimethyl Phthalate, Dibutyl Phthalate, Benyl Benzoate, 2–ethylhexanediol (Rutgers 612), and tobacco juice all seem effective repellants until they wash off, but they do wash off, and for application to the skin I can offer no remedy. The 'new dope' referred to by Mr. Smythies as reported in *Nature* (Traub *et al* 1952, also IMR 1954, Audy and Harrison 1954) was not, in fact developed specifically as a leech repellant but as a general purpose repellant for impregnating army uniforms against mosquitoes, lice, bedbugs, fleas, and all the other pests of soldiers. It proves to be very effective against leeches, both land and water leeches, and it remained effective even after a lot of wading through

rivers and washing of the clothes. The composition of the particular mixture tested was :—

n-butylacetanilide	...	3 parts
2-butyl-2-ethyl-1·3 propanediol	...	3 parts
benzyl benzoate	...	3 parts
emulsifier (' Tween 80 ')	...	1 part.

This concentrate was emulsified with water in which the garments were soaked at the rate of about two fluid ounces per garment (jacket or pair of trousers).

Insecticides

The insecticides Lindane, Aldrin, and Dieldrin have been tried against leeches. In the concentrations usually used against insects they had no effect whatever. (IMR 1954).

Questions

This is an attempt to give some answer to a few of the questions raised by Mr. Smythies, but I should not like to give the impression that I think these questions are settled. My own slight acquaintance with the subject serves but to impress me with how little is known about one of the most notorious pests of this part of the world. The questions of which I should like most to know the answer are: ' What are the normal hosts of land leeches ?' ' Are leeches ever found on freshly shot animals, if so how often and how many ?' I would also like to know of any actual estimates of leech populations.

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